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**BEFORE THE BOARD OF PATENT APPEALS
AND INTERFERENCES**

Application Number: 09/818,575
Filing Date: March 28, 2001
Appellant(s): YONA ET AL.

Guy Yonay
Reg. No. 52,388
For Appellant

EXAMINER'S ANSWER

This is in response to the appeal brief filed on November 23, 2005 appealing from the Office action mailed April 28, 2005.

(1) Real Party in Interest

A statement identifying by name the real party in interest is contained in the brief.

(2) Related Appeals and Interferences

The examiner is not aware of any related appeals, interferences, or judicial proceedings which will directly affect or be directly affected by or have a bearing on the Board's decision in the pending appeal.

(3) Status of Claims

The statement of the status of claims contained in the brief is correct.

(4) Status of Amendments After Final

The appellant's statement of the status of amendments after final rejection contained in the brief is correct.

(5) Summary of Claimed Subject Matter

The summary of claimed subject matter contained in the brief is correct.

(6) Grounds of Rejection to be Reviewed on Appeal

The appellant's statement of the grounds of rejection to be reviewed on appeal is correct.

(7) Claims Appendix

The copy of the appealed claims contained in the Appendix to the brief is correct.

(8) Evidence Relied Upon

5,198,928	CHAUVIN	3-1993
5,652,666	FLORENCE ET AL	7-1997
6,094,283	PRESTON	7-2000

Pages 331-335 of 1965 Edition of the book "applied Optics and Optical Engineering" by Rudolf Kingslake.

Pages 234-235 of 1998-99 catalog for laser and photonics applications from Coherent.

(9) Grounds of Rejection

The following ground(s) of rejection are applicable to the appealed claims:

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 1-7, 9-16, 18-23, 35 and 37 are rejected under 35 U.S.C. 103(a) as being unpatentable over the patent issued to patent issued to Preston (PN. 6,094,283).

Preston teaches a *holographic display* (either the left optical system 26 or the right optical system 28) that is comprised of an *image source* (30, Figure 1) to produce at least *a first and second complementary images* along a *common optical axis* wherein the complementary images are differing in *wavelength,* (i.e. the image comprises red, green and blue complementary images, please see column 3, lines 60-65). The display further comprises a *relay optics* (32) having a field of view associated with it, a *redirecting unit* (34 and 36) coupled to the image source for directing the complementary images to at least a first and second respective spatial regions of a *reflecting units* (38) *based on the wavelength property* of the complementary images, wherein the images are reflected by the reflecting unit so that a *single* eye of the observer is capable of viewing the first and second *complementary images* as an integral image, namely an integrate full color images, (please see Figure 1, either the left optical system 26 or the right optical system 28, column 3, lines 18-65).

Preston teaches that the redirecting unit (34 and 36) each comprises a **stack** of *spatially adjacent red, green and blue holograms* (60, 62 and 64, please see column 6, lines 48-68) that *each* redirects **only one of** the red, green or blue components or complementary images, ***respectively,*** which means the redirection is based on wavelength property. The reflecting unit or the eyepiece (38) is also comprised of a **stack** of *spatially adjacent red,* green and blue holograms that are *spatially* separated from each other, (please Figure 7, column 7, lines 45-50), wherein each of the holograms **only** *reflects* **one of the** red, blue or green color complimentary images to the single eye of the observer, (please see Figure 1), such that the different color complementary images can be viewed by the observer together as an integrated full color image. This means that different wavelength components or complementary images are reflected by different holograms at *different* spatial locations. The redirecting units (34 and 36) therefore is "*coupled to direct at least said first and second image to at least first and second different respective spatial regions of the reflecting unit*". The wavelength selectivity of the red, green or blue hologram that only diffracts or functions on red, green or blue light is the fundamental properties of holograms.

This reference has met all the limitations of the claims with the exception that it does not teach *explicitly* that the field of view of the integrated image is wider than the field of view of the relay optics. Preston however does teach that the redirecting unit (34 and 36) comprises a narrow field beam device and a wide field beam device that re-images the image from the relay lens and *magnifies* the resultant image, (please see column 3, lines 27-45). The resultant image of the optical system that presents to the eye is at a distance from the eye, (please see column 3, lines 39-41). It would then have been obvious to one skilled in the art to modify the geometrical arrangement of the various elements and the field properties of the re-directing unit so that the final integrated image appears to have a greater field of view than the field of view of the relay optics for the benefit of increasing the view field of the holographic display.

With regard to claims 2-4, 11-13, and 20-23, the reflecting unit or the eyepiece (38) is a diffractive holographic element having optic power for converging the complementary images to form a composite or integrated full color image. This reference however does not teach explicitly that the holographic optical element is a binary optics. Binary optics is one of well-known types of diffractive holographic element in the art that has good diffraction efficiency and less energy loss due to its binary design. It would then have been obvious to one skilled in the art to use a binary type diffractive holographic optical element as the reflecting unit for the benefit of providing known type diffractive holographic optical elements to achieve the same functions and with good diffraction efficiency. **Preston** teaches that the image display apparatus could be applied as *head mount display*, (with respect to claim 10 also), which implicitly requires the observer being capable of viewing the surrounding scene also. Although this reference does not teach explicitly to make the power of the holographic optical element to have zero optical power for surrounding scene by providing a corrector hologram, however such practice is standard in the art for the benefit stated above, such modification would therefore have been obvious to one skilled in the art.

With regard to claims 5-6, 14-15, 24, 27, and 31, Preston teaches that the number of complementary images is at least three and the images are different in color or wavelength. The reflecting unit (38) is wavelength selective.

With regard to claims 7, 9, 16, 18 and 30, this reference however does not teach explicitly that the complementary images are different in polarization state and the redirecting unit is polarization selective reflecting device. However the instant application fails to provide an operable model using polarization mode **in the claims,** it therefore cannot be examined with details. It would have been obvious to one skill in the art to make the holograms (60, 62 and 64) polarization selective so that different polarization states of the image light will be redirected and reflected by holographic elements (34, 36 and 38) independently. Polarization selective hologram is very well known in the art.

With regard to claims 25-26, 28-29, 32-33, 35, and 37, Preston teaches that the different color components of the image or the complementary images can be *sequentially* generated to different spatial regions or different holograms of the reflecting unit (38) wherein the different holograms are adjacent to each other, (please see column 3, lines 60-65). Although this reference does not teach that the complementary images can also be generated simultaneously, such modification is considered to be an obvious matters of design choice to one skilled in the art for the benefit of allowing different types of image sources being utilized since the redirecting unit and the reflecting unit are all operated based on wavelength property to either sequentially generate the different color complementary images or to generate them simultaneously will provide the same resultant integrated image.

Claims 34, 36 and 38 are rejected under 35 U.S.C. 103(a) as being unpatentable over the patent issued to Preston as applied to claims 1, 10 and 19 above, and further in view of the patent issued to Chauvin (PN. 5,198,928).

The holographic image display taught by **Preston** as described for claims 1, 10 and 19 above has met all the limitations of the claims. This reference teaches that the images are generated by image source (30) but does not teach explicitly that the images are generated using two image sources and a combiner. However such arrangement is rather standard in the art to generate a combined image with different optical coding of the image components, as illustrated by **Chauvin**. **Chauvin** teaches an apparatus to generate an image along a single optical axis wherein the image comprises two image components each intended for different optical coding property, wherein two image sources (22 and 24) are used to generate a first and a second image components wherein a pair of filters (26 and 28) is used to code the image components respectively with different optical properties and a combiner (30) is then used to combine the two image components, (please see Figure 1) to create a combined image along a single optical axis, (the optical axis of the combiner and lens (32)). It would then have been obvious to one

skilled in the art to apply the teachings of **Chauvin** to modify the image source of **Preston** for the benefit of providing the possibility of individual modulation for the image components respectively.

Claims 8 and 17 are rejected under 35 U.S.C. 103(a) as being unpatentable over the patent issued to Florence et al (PN. 5,652,666).

Florence et al teaches a *holographic display system* that is comprised of a *spatial light modulator* or *digital micro-mirror device* (14, Figure 4), serves as the *image source*, for generating a *plurality of stripes of image* representing a plurality of holographic image strips, that serves as the *at least first and second complementary images*. The display system further comprises a set of lenses (41-43) serves as the *relay optics* with associated field of view for directing the complementary images to a *scanning mirror* (45), serves as the *redirecting unit*, that is *rotatable* for scanning and *redirecting* the stripes of image to a *cylindrical lens* (44) so that the plurality of the image strips are formed at different spatial locations on the image observation plane (46) that allows an observer's eye to view the plurality of image strips as **an integrated composite hologram image,** (46, please see Figures 1, 3 and 4, columns 2-3). As shown in Figure 1, the plurality of image strips generated from spatial light modulator or DMD (14) is along a single optical axis. The redirecting unit is the scanning mirror which is tilted from the rotational axis.

This reference has met all the limitations of the claims. Although this reference does not teach explicitly that the image strips or complementary images are being directed to different spatial locations on the cylindrical lens, however such feature has to be implicitly met since the plurality of complementary images are swept by the scanning mirror across different spatial locations on the image plane (46) via the cylindrical lens to form the integrated image. The different images therefore also have to be swept across different spatial locations on the cylindrical lens. This reference however does not teach explicitly that the cylindrical lens is a *reflecting* unit. But such modification would have been obvious to one skilled in the art since a cylindrical mirror is commonly known in the art and such

modification would have the benefit of folding the image beams path so that the display can be made with a more compact design.

This reference also does not teach *explicitly* that the field of view of the integrated image observed at the image plane (46) is wider than the field of view of the relay optics. However the final resultant image is a composite image of all of the image strips generated by the spatial light modulator, (14), it would require the field of view of the integrated image to be wider than the field of view of the relay optics that relays the image strips or complementary images to form the integrated image in order for the integrated image be properly viewed.

(10) Response to Argument

A. <u>Claims 1-7, 9-16, and 18-38 comply with the enablement requirement of 35 USC 112, first paragraph.</u>

Upon review the arguments provided in the appeal brief, the rejections are withdrawn.

B. <u>Claims 1-7, 9-16, 18-23, 35 and 37 are patentable under 35 USC 103 over Preston</u>

In response to appellant's statements which state that the cited Preston reference teaches a holographic display system comprises a left and right optical systems that each comprises an image display operable to display an input image and firs and second holographic devices, the examiner agrees applicant's statements but wants to emphasize as explicitly stated in the reasons for rejection only *one* of the right or left optical systems is used to reject applicant's apparatus since applicant's apparatus is intended for *an eye* of the viewer, (please see claims 1, 10 and 19). Since only one of the left or right optical systems is used, the arguments concerning the images intended for right eye and for left eye do not physically overlap on the eye piece, (page 14 paragraph 1 of the brief) are wrong and irrelevant. The

images intended for right eye and for left eye of Preston references are not the images being considered here.

In response to appellant's arguments which state that Preston reference teaches "each of the image display units takes a single image and decomposes it into RBG components and transmits each of these separately to the same area of the eye pieces 38 thereby creating the single image" (page 13 paragraph 6), appellant's arguments which state that Preston reference doe not each "first and second complementary images ... bur rather first and second color components of the same images" (page 14, paragraph 2) and appellant's arguments which state "because each input image display 40 (of Preston) displays a single image in its color components and not two different images (as recited in independent claims 1 and 10), the same single image of Preston is reconstructed at the same area of the eye pieces 38," (page 14 paragraph 3) the examiner respectfully disagrees for the reasons stated below.

Firstly, the independent claims of the instant application **never** claim the images are different, rather claims 1 and 10 recite "*first and second complementary images differing in at least one optical properties selected from the group consisting of polarization and wavelength*". Preston teaches for each image display unit a plurality of images of different wavelengths, (i.e. red, green and blue images), are generated by the image source (30, column 3, lines 60-65), wherein these images of different color components are the *at least first and second complementary images that differing in at least one optical properties namely the wavelength.* These different color image components are complementary images since *together* they form a single integrated full color image. The dictionary definition for the word "complementary" is "making a complement". By this definition these color image components have to be complementary images for they make a complement of an integrated full color image. The specification of the instant application recites the phrase "complementary fractions of the image", (page 2, line 12). These color image components of Preston are "complementary fractions" of the integrated full color image.

Secondly, as explicitly stated in the grounds of rejection above, Preston teaches explicitly that the eyepieces (38) comprises a switchable holographic device containing red, green and blue sensitive mirrors, (please see column 7, lines 43-59), which means that the eyepiece comprises switchable red hologram, green hologram and blue hologram that physically cannot be at same spatial locations, for diffracting red, green and blue image component *respectively*. Figure 1 demonstrates that the eyepiece 38 have stacked layer structure of red, green and blue holographic sensitive mirrors, Figure 7 demonstrates standard stacked layers of red, green and blue holograms. Since a hologram is wavelength sensitive and selective, which means red hologram can only diffracts and reflects, in this case, red image components, the different complementary images of different color or wavelength property have to be directed at different holograms or *different spatial locations of the eyepiece 38* to allow each color image components or complementary image by the proper hologram to enable the integrated full color image to an eye of the observer.

For the above reasons the Preston reference does teach "directing first and second complementary images to at least first and second respective spatial regions of a reflecting unit based on said different optical property".

In response to appellant's arguments which state that the Preston reference does not teach the widening of the field of view is "performed by one relay optics", (page 14, paragraph 4), the examiner respectfully disagrees for the reasons stated below. The claims of instant application do not disclose that the widening of the field of view is "performed by one relay optics", the feature therefore cannot be relied upon to overcome the rejection. Furthermore, the specification of the instant application *never* teaches that the widening of the field of view is "performed by one relay optics" and it cannot be so since the relay optics has an *associated* field of view and the widening is really compared to this *associated* field of view. It is impossible to widen the *associated* field of view by the element itself.

In response to appellant's arguments which state that Preston does not teach to (a) an image source to produce along a common optical axis at least first and second complementary images nor (b) a reflecting unit coupled to said image source to direct at least said first and second images to at least first and second, respective spatial regions of a reflecting units, (page 14 last paragraph and page 15 first two paragraphs), the examiner respectfully disagrees for the reasons stated above and below. Figure 1 of Preston, teaches explicitly that the first and second complementary images of different wavelength property are along a common optical axis, (along optical axis of relay optics 32). The feature concerning "respective first and second spatial regions on the reflecting unit" has been explicitly taught and explained in the ground of rejections and arguments above.

For these reasons claims 1-7, 9-16, 18-23, 35 and 37 therefore are rejected under 35 USC 103 over Preston.

C. <u>Claims 34, 36 and 38 are patentable under 35 USC 103(a) over Preston in view of Chauvin</u>

In response to appellant's concerns about Chauvin teaches "separated image sources generate the left and right eye imagery" (page 15, last paragraph), the examiner wishes to emphasize that the Chauvin reference is provided in particularly to demonstrate that it is known in the art to use two image sources and a combiner, (as explicitly claimed in claims 34, 36, and 38), to generate complementary images differing in optical property such as wavelength or polarization along a common optical axis. The similar arrangement having more than one image generating means and a combiner to generate complementary images along common optical axis can also be found in ordinary color television set.

In response to appellant's arguments which state that Chauvin does not teach "an image source to produce along a common optical at least first and second complementary images and/or (b) a redirecting unit coupled to said image source to said image source to direct at least said first and second images to at

least first and second respective spatial regions of a reflecting unit", (page 16, first paragraph), these features have been met by the primary Preston reference. In addition, Chauvin does teach to generate first and second images differing in optical property to along a common optical axis, (please see Figure 1 the common optical axis after the combiner).

For these reasons, Claims 34, 36 and 38 therefore are rejected under 35 USC 103(a) over Preston in view of Chauvin.

<u>D. Claims 8 and 17 are patentable under 35 USC 103(a) over Florence</u>

In response to appellant's arguments concerning the *prima facies* case of obviousness concerning Florence reference has not been established, the examiner respectfully disagrees. As stated in the grounds of rejections a cylindrical mirror, (i.e. a reflecting element as opposed to a transmission element), is commonly known in the art it would have been obvious to one skilled in the art to use a cylindrical mirror as the reflecting unit instead of the transmission cylindrical lens to enable the views since they function the same, namely enabling the view to the observer as required by the claims, and a reflection mode has the benefit of folding the image beams path so that the display can be made with a more compact design. Since the reasons for rejection provide the teachings and motivation, the prima facies case of obvious is established.

In response to appellant's statements which "in Florence, an entire image is produced by an image source but only portions of the image are viewed at the image plane in a scanning action" (page 17, second paragraph), the examiner disagrees for the reasons stated below. Figure 3 of Florence, teaches explicitly that 33 vertical strips make up an integrated image at the image plane but each stripe is generated by the image source (14 DMD) at a scanning action to allow all 33 strips to be formed at the image plane for viewing. If the entire image is being generated by the image source then it is impossible for the scanning mirror to scan the proper image strips to the proper locations at the image plane.

Furthermore, whether a portion of the image being viewed at the image plane or not does not make Florence different from the instant application since the fast scanning rate of the scanning mirror allow the entire image being viewed by the observer.

In response to appellant's arguments which state that the Florence reference does not disclose "an image source to produce along a common optical axis at least first and second complementary images" the examiner respectfully disagrees for Florence teaches explicitly that the plurality of image strips that serves as the at least first and second complementary images are generated by the image source (14) along a common optical axis, (please see Figure 1).

For these reasons, claims 8 and 17 therefore are rejected under 35 USC 103(a) over Florence.

(11) Related Proceeding(s) Appendix

No decision rendered by a court or the Board is identified by the examiner in the Related Appeals and Interferences section of this examiner's answer.

For the above reasons, it is believed that the rejections should be sustained.

Respectfully submitted,

Audrey Chang

Conferees:

Darren Schuberg

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